

# RESERVE PATENT SPECIFICATION

756,907



Date of Application and filing Complete Specification: Nov. 9, 1954.

No. 32373/54.

Application made in Switzerland on Nov. 9, 1953.

(Patent of Addition to No. 665,802, dated Nov. 4, 1949).

Complete Specification Published: Sept. 12, 1956.

Index at acceptance:—Class 56, M3A, MS9.

## COMPLETE SPECIFICATION

### Improvements in or relating to a Process and Apparatus for the Manufacture of Fibres from Plastic Material

We, ALGEMEENE KUNSTVEZEL MAAT-  
SCHAPPIJ NAAMLooZE VENootSCHAP, a  
Company organised under the Laws of Hol-  
land, of 261, Benoordenhoutseweg, The  
5 Hague, Holland, do hereby declare the in-  
vention, for which we pray that a patent  
may be granted to us and the method by  
which it is to be performed, to be particu-  
larly described in and by the following  
10 statement:—

The present invention relates to a pro-  
cess for the manufacture of fibres from  
plastic material particularly from glass in  
the liquid state, of the kind in which the  
15 plastic material is caused to flow in the  
form of streams in a gaseous fluid under  
pressure, the said streams being drawn into  
fibres by means of this fluid.

In a process of the above kind which is  
20 described in our British Patent No. 665,802  
the said streams and the gaseous fluid are  
caused to pass through an expansion chan-  
nel having at least one divergent outlet of  
which the outlet forms the downflow end  
25 of the channel, the angle of divergence of  
the walls relatively to the axis of the chan-  
nel being less than 1 degree 30 minutes  
and the ratio of the surface of the outlet  
and inlet of the divergence being less than  
30 4. For the same ratio values between the  
absolute pressures upstream and down-  
stream of the expansion channel, fluid  
speeds can be obtained in the part of the  
channel corresponding to the minimum  
35 section or neck of the divergent outlet  
greater than those which would be ob-  
tained in a channel of uniform section. The  
attenuating effect exerted by the gaseous  
fluid on the streams of plastic material is  
40 thus improved. The apparatus for putting  
this process into operation comprises a  
bushing for the plastic material and an  
expansion channel for the gaseous fluid  
under pressure, the entry of the said chan-  
45 nel being arranged in the vicinity of the

bushing orifices, the said channel having  
at least one outlet part in divergent form.  
The channel may be entirely divergent, the  
cross section being circular or substantially  
50 circular or even in the form of an elon-  
gated rectangle according to whether the  
apertures of the bushing of the container  
holding the plastic material are situated on  
one or more concentric circles or on one or  
55 more parallel rectilinear rows. The chan-  
nel may also comprise, upstream from the  
divergence, a convergent portion enabling  
still higher speeds to be obtained at the  
neck of the divergent part for one and the  
60 same ratio between the absolute pressures  
of the fluid upstream and downstream of  
the channel. It is possible, moreover, with  
the convergent-divergent to obtain the best  
conditions of operation of the divergent  
65 by giving the latter a straight section cir-  
cular in shape. This shape has in fact been  
recognised as the most favourable, what-  
ever the arrangement of the apertures of  
the bushing of the container. If these aper-  
70 tures are arranged in one or more parallel  
rows, the convergent part is then of a suit-  
able shape to assure a progressive change  
in the straight section of the channel from  
a rectangular shape to a true circular shape  
75 at the neck of the divergent part.

It has been found that the tractive force  
exerted by the flow of gaseous fluid on the  
fibres of plastic material, and which deter-  
mines the diameter of the fibres obtained  
80 from streams of a given diameter, and for  
a plastic material having determined pro-  
perties and which is allowed to flow in  
streams at a determined temperature, de-  
pends not only on the maximum speed  
85 and conditions of flow of the gaseous liquid  
in the expansion channel, but also on the  
conditions of flow of this fluid in the  
vicinity of the apertures of the bushing  
and before its entry into the expansion  
90 channel. In particular, it has been found

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to be possible, with a given expansion channel and definite conditions of pressure and maximum speed of gaseous fluid, to improve the effect of drawing produced by this gaseous fluid by acting on the conditions of flow of this fluid in the vicinity of the bushing apertures and the entry into the expansion channel.

The process of the present invention is an improvement of the process above described and is characterised by the fact that a turbulence is caused in the flow of the gaseous fluid before the entry of this fluid into the said expansion channel and in the immediate vicinity of the bushing apertures through which the said plastic material flows in the form of streams.

The apparatus for carrying out the process of the invention is distinguished from the apparatus described in our British Patent No. 665,802 by the fact that it comprises, moreover, at least one obstacle arranged in the path of the gaseous fluid to produce, in the vicinity of the said bushing apertures and upstream from the entry into the said channel, a sudden change in the flow of the gaseous fluid. The obstacle or obstacles may consist of one or more elements, e.g. in sheet metal, fixed on at least one of the walls delimiting the passage of the gaseous fluid before its entry into the expansion channel and into the vicinity of the bushing apertures. These obstacles may be arranged on the wall of an enclosure containing the gaseous fluid and/or on the wall of a container holding the plastic material.

In order that the invention may be more readily understood three embodiments of apparatus according to the invention will now be described with reference to the accompanying drawing, in which:—

Fig. 1 is an elevation view in cross section of a first form of apparatus;

Fig. 2 is an elevational view in longitudinal section of Fig. 1;

Fig. 3 is a partial view similar to the view of Fig. 1 of a second form of apparatus;

Fig. 4 is a partial sectional view on the line 4—4 of Fig. 3; and

Fig. 5 is a view similar to that of Fig. 1 of a third form of apparatus.

Each of the forms of apparatus represented comprise a container 1 holding the plastic material, e.g. melted glass 2. This container is entirely housed inside an enclosure 3 in which gaseous fluid under pressure is introduced by apertures 4 and 5. Container 1 consists of a metal crucible fitted at the bottom with bushing apertures 7 through which the plastic material may flow in fine streams. These bushing apertures are arranged in one or more parallel straight rows. A crucible 6 is surrounded

by a refractory body 9, the bottom part of which is held on a sheet of metal 10 which serves, together with the bottom of the enclosure 3, for delimiting a passage for the flow of gaseous fluid upstream from the place where this current enters into the stop channel.

Container 1 is heated by the passage of an electric current through the walls of the metal crucible 6 which serves as a heating resistance, the ends of this crucible being connected to current leads (not shown). The material to be melted, for example, in the form of cullet or marbles, is introduced into the crucible through a conduit 11 fitted with two baffles 12 and 13 which form a lock. The gaseous fluid under pressure intended for surrounding the streams of molten material and attenuating these streams passes into an expansion channel 15, into which it passes through aperture 14.

In the first form of apparatus shown in Figs. 1 and 2, the expansion channel 15 is slightly divergent and has a straight section in the form of an elongated rectangle which is adapted to the arrangement of the bushing aperture 7 in two rows. In the second form of apparatus, the expansion channel is substantially identical with that of the first form, although the crucible 6 of this form of apparatus has only a single row of bushing apertures 7. Finally, in the straight form of apparatus shown in Fig. 5, the expansion channel comprises a convergent part 16 arranged in the immediate vicinity of bushing apertures 7 of crucible 6 which are arranged in two straight rows, and a divergent part 17 which extends to convergent part 16 and which goes as far as the outlet from the channel. In this last form of apparatus and in order to obtain better conditions of flow of the gaseous fluid in the divergent part 17, the convergent portion 16 has successive cross sections in the desired shape in order to connect its inlet of cross section substantially rectangular with the neck of the expansion channel which is at the entry of divergent portion 17 and which has a cross section circular in form. It has been found, in fact, that a divergence of circular cross section has a better yield for the drawing of the fibres of plastic material. Furthermore, in order to avoid friction of the column of gaseous fluid in the divergent part of the expansion channel, the angle of divergence of this channel, i.e. the angle formed by its walls in relation to its axis, is less than 1 degree 30 minutes, and the ratio between the outlet cross section of the divergent part and the cross section of the neck of the expansion channel is less than 4.

In order to cause a turbulence in the

flow of gaseous fluid before the entry of this fluid into the expansion channel, obstacles 18 are arranged which are fixed to the sheet metal 10 in proximity to the bushing apertures and on either side thereof. Each of these obstacles has a portion 18a which extends through the path of the flow of gaseous fluid and causes a sudden variation in the section and direction of flow of this fluid.

Apart from the obstacles 18, the second form of apparatus comprises a second row of similar obstacles 19 which are also fixed on the metal sheet 10, and the third form of apparatus also comprises obstacles 20 fixed at the bottom of the enclosure. The eddies created in the flow of gaseous fluid by obstacles 18, 19 and 20 before the entry of this fluid into the stop channel contribute towards assuring a better attenuation of the streams of plastic material by the flow of gaseous fluid. For example, in the course of experiments of drawing the threads of molten glass, an increase was found of the order of 15-25% of the tractive force exerted by the flow of gaseous fluid according to the speed of the current and the final diameter of the fibres obtained. The obstacles such as those represented at 18, 19 and 20 may extend in a continuous manner the full length of a row of bushing apertures or, on the contrary, may be discontinuous as shown in Fig. 4 in which it can be seen that obstacles 18 each comprise a curved part 18a cut in the form of notches.

What we claim is:—

1. A process for the manufacture of fibres from plastic material, in particular glass in the melted state, comprising the steps of causing the material to flow in the form of streams in a gaseous fluid under pressure, the said streams being drawn into fibres by means of the fluid, causing the said streams and gaseous fluid to pass through an expansion channel having at least one outlet part in the form of a divergent portion of which the outlet forms the down-flow end of the channel, the angle of divergence of the walls relatively to the axis of the channel being less than 1 degree 30 minutes and the ratio of the surface of the outlet and inlet of the divergence being less than 4, and causing a turbulence in the flow of gaseous fluid before the entry of this fluid into the said expansion channel and in the immediate vicinity of bushing apertures through which the plastic material flows.

2. A process as claimed in claim 1,

wherein the turbulence is produced by means of obstacles arranged in the path of the flow of gaseous fluid in the vicinity of the bushing apertures and upstream from the inlet to the said expansion channel so as to produce a sudden change in the flow of gaseous fluid.

3. Apparatus for carrying out the process of claim 1, comprising a bushing for the said plastic material and an expansion channel for the said gaseous fluid under pressure, the inlet to this channel being arranged in the vicinity of the bushing apertures and the said channel having at least one outlet part in the form of a divergent portion, and at least one obstacle arranged in the path of the flow of the gaseous fluid, which obstacle causes a sudden change in the flow of gaseous fluid in the vicinity of the said bushing apertures and upstream from the inlet to the said channel.

4. Apparatus according to Claim 3, wherein the said obstacle consists of a piece fixed on the wall of an enclosure containing the gaseous fluid under pressure in the vicinity of the entry of the expansion channel.

5. Apparatus according to Claim 3, wherein the said obstacle is fixed on an envelope of the container holding the plastic material in the vicinity of the said bushing apertures.

6. Apparatus according to any one of the preceding Claims 3 to 5, wherein the said expansion channel is part divergent and part convergent.

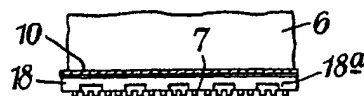
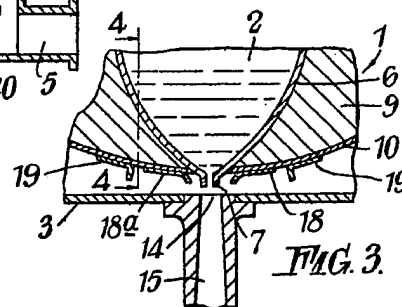
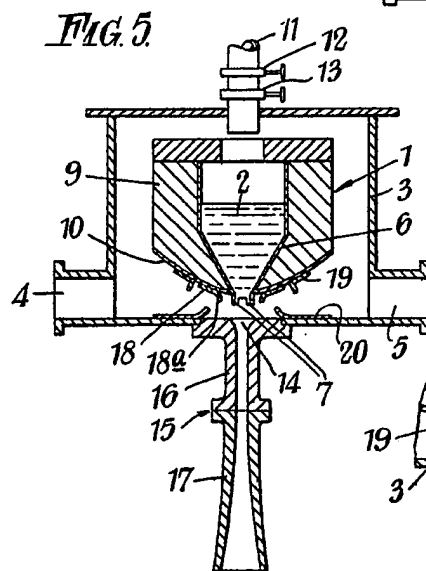
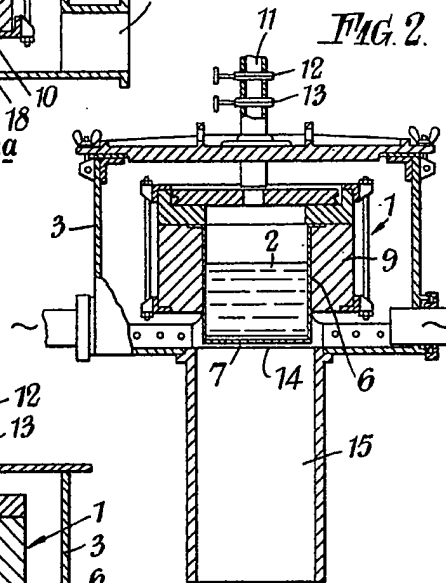
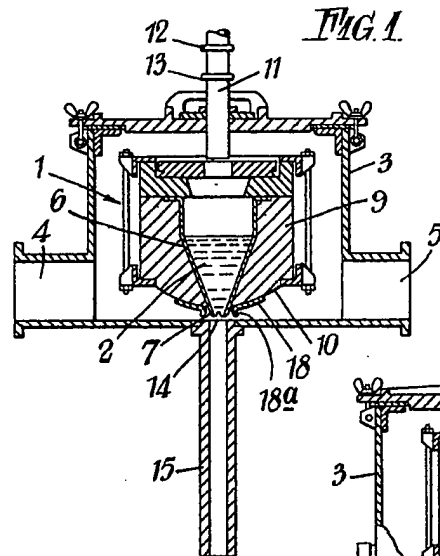
7. Apparatus according to any one of the preceding Claims 3 to 7 wherein the expansion channel has a circular cross section, at least in its divergent part.

8. Apparatus according to any one of the preceding Claims 3 to 7, wherein the said expansion channel has a cross section in the form of an elongated rectangle.

9. A process for the manufacture of fibres from plastic material, in particular glass in the melted state, substantially as herein described.

10. Apparatus for the manufacture of fibres from plastic material, in particular glass in the melted state, substantially as herein described with reference to the accompanying drawing.

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*FIG. 4.*